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Dataset Information:

Funding_Info: NOAA Climate Program Office; NOAA Ocean Acidification Program
Initial_Submission: 20150703
Revised_Submission: 20160130

Cruise Information:

Experiment Name: EX1441
Experiment Type: SOOP Line
Platform Type: Ship
Co2 Instrument Type: Equilibrator-IR or CRDS or GC
Cruise ID: 33KF20141023
Cruise Info: AOML_SOOP_CO2
Geographical Region:
- Westernmost Longitude: -74.0
- Easternmost Longitude: -63.0
- Northernmost Latitude: 40.6
- Southernmost Latitude: 18.0

Cruise Dates (YYYYMMDD)
- Start_Date: 20141023
- End_Date: 20141101

Ports of Call:
- Bayonne, NJ
- Kings Wharf, Bermuda
- Phillipsburg, St. Maarten
- San Juan, Puerto Rico
- Labadee, Haiti

Vessel Name: Explorer of the Seas
Vessel ID: 33KF
Vessel Owner: Royal Caribbean International

Variables Information:

Variable Name: xCO2_EQU_ppm
Description of Variable: Mole fraction of CO2 in the equilibrator headspace (dry) at equilibrator temperature (ppm)
Unit of Variable: ppm

Variable Name: xCO2_ATM_ppm
Description of Variable: Mole fraction of CO2 measured in dry outside air (ppm)
Unit of Variable: ppm

Variable Name: xCO2_ATM_interpolated_ppm
Description of Variable: Mole fraction of CO2 in outside air associated with each water analysis. These values are interpolated between the bracketing averaged good xCO2_ATM analyses (ppm)
Unit of Variable: ppm

Variable Name: PRES_EQU_hPa
Description of Variable: Barometric pressure in the equilibrator headspace (hectopascals)
Unit of Variable: hPa

Variable Name: PRES_ATM@SSP_hPa
Description of Variable: Barometric pressure measured outside, corrected to sea level (hectopascals)
Unit of Variable: hPa

Variable Name: TEMP_EQU_C
Description of Variable: Water temperature in equilibrator (degrees Celsius)
Unit of Variable: Degree C

Variable Name: SST_C
Description of Variable: Sea surface temperature (degrees Celsius)
Unit of Variable: Degree C

Variable Name: SAL_permil
Description of Variable: Sea surface salinity on Practical Salinity Scale (permil)
Unit of Variable: ppt

Variable Name: fCO2_SW@SST_uatm
Description of Variable: Fugacity of CO2 in sea water at SST and 100% humidity (microatmospheres)
Unit of Variable: µatm

Variable Name: fCO2_ATM_interpolated_uatm
Description of Variable: Fugacity of CO2 in air corresponding to the interpolated xCO2 at SST and 100% humidity (microatmospheres)
Unit of Variable: µatm

Variable Name: dfCO2_uatm
Description of Variable: Sea water fCO2 minus interpolated air fCO2 (microatmospheres)
Unit of Variable: µatm

Variable Name: WOCE_QC_FLAG
Description of Variable: Quality control flag for fCO2 values (2=good, 3=questionable)
Unit of Variable: None

Variable Name: QC_SUBFLAG
Description of Variable: Quality control subflag for fCO2 values, provides explanation when QC flag=3
Unit of Variable: None

Method Description:

Equilibrator Design:

Depth of Seawater Intake: 5 meters
Location of Seawater Intake: Forward port side, just above the bow thruster tunnel
Equilibrator Type: Sprayhead above dynamic pool, with thermal jacket
Equilibrator Volume: 0.95 L (0.4 L water, 0.55 L headspace)
Water Flow Rate: 1.5 - 2.5 L/min
Headspace Gas Flow Rate: 70 - 150 ml/min
Vented: Yes
Drying Method for CO2 in Water:
Gas stream passes through a thermoelectric condenser (~5 °C) and then through a Perma Pure (Nafion) dryer before reaching the analyzer (90% dry).
Additional Information: Primary equilibrator is vented through a secondary equilibrator

CO2 in Marine Air:

Measurement: Yes, 5 readings in a group every 3.2 hours
Location and Height: On bow mast at ~20 meters above the sea surface
Drying Method:
Gas stream passes through a thermoelectric condenser (~5 °C) and then through a Perma Pure (Nafion) dryer before reaching the analyzer (90% dry).

CO2 Sensor:
Measurement Method: Infrared absorption of dry sample gas
Manufacturer: LI-COR
Model: 6262
Frequency: Every 140 seconds, except during calibration
Resolution Water: 0.01 microatmosphere
Uncertainty Water: ± 1 microatmospheres
Resolution Air: 0.01 ppm
Uncertainty Air: ± 0.2 ppm
Manufacturer of Calibration Gas:
ESRL, Boulder - Std 1: Commercial UHP Nitrogen, 0.00 ppm / Std 2: CA04890, 282.59 ppm / Std 3: CC115007, 381.54 ppm / Std 4: CB09022, 537.45 ppm
Number of Non Zero Gas Standards: 3
CO2 Sensor Calibration:
The analyzer is calibrated every 3.2 hours using standards directly traceable to the WMO scale.
Other Comments:
Instrument is located in the ship's air-conditioned bow thruster space. Ultra-High Purity nitrogen gas (0.0 ppm CO2) and the high standard are used to zero and span the LI-COR analyzer.
Method References:
Pierrot, D., C. Neil, K. Sullivan, R. Castle, R. Wanninkhof, H. Lueger, T. Johannessen, A. Olsen, R. A. Feely, and C. E. Cosca (2009), Recommendations for autonomous underway pCO2 measuring systems and data reduction routines, Deep-Sea Res II, 56, 512-522.
Details Co2 Sensing:
details of CO2 sensing (not required)
Measured Co2 Params:
xco2(dry)

Sea Surface Temperature:
Location: In bow thruster room between the inlet and sea water pump

Manufacturer: Seabird
Model: SBE-38
Accuracy Degrees Celsius: 0.001
Precision Degrees Celsius: 0.00025
Calibration: Factory calibration.
Comments: Manufacturer's Resolution is taken as Precision; Maintained by other scientists.

Equilibrator Temperature:
Location: Inserted into equilibrator ~ 5 cm below the water level.
Manufacturer: Hart
Model: 1523
Accuracy Degrees Celsius: 0.015
Precision Degrees Celsius: 0.001
Calibration: Factory calibration
Comments: Manufacturer's Resolution is taken as Precision.

Equilibrator Pressure:
Location: Attached to equilibrator headspace
Manufacturer: Setra
Model: 239
Accuracy hPa: 0.052
Precision hPa: 0.01
Calibration: Factory calibration
Comments:
Differential pressure reading from Setra-239 attached to the equilibrator headspace was added to the pressure reading from the Setra-270 on the exit of the analyzer to yield equilibrator pressure. Manufacturer's Resolution is taken as Precision.

Atmospheric Pressure:
Location: On mast above bridge and atmospheric lab, ~59 m above sea surface.
Manufacturer: R.M.Young
Model: 61302V
Accuracy: ± 0.3 hPa
Precision: 0.15 hPa
Calibration: Factory calibration
Normalized: yes
Comments: Manufacturer's Resolution is taken as Precision; Maintained by other scientists.

Sea Surface Salinity:
Location: In bow thruster space, next to CO2 system.
Manufacturer: Seabird
Model: SBE 45
Accuracy: ± 0.005 permil
Precision: 0.0002 permil
Calibration: Factory calibration
Comments: Manufacturer's Resolution is taken as Precision; Maintained by other scientists.

Additional Information:

The CO2 analytical system performed well for most of this cruise. For the 38-hour transit between Bayonne and Bermuda, the sea water flow was variable due to inlet problems.

Preliminary Quality Control:

NA

Form Type:

underway